UNIVERSITI TEKNIKAL MALAYSIA MELAKA

HOME AUTOMATION USING POWER LINE NETWORKING AND RF REMOTE CONTROL

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

By

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor Of Electronics Engineering Technology (Industrial Electronics) With Honours. The member of the supervisory is as follow:

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ABSTRAK

Laporan ini akan membentangkan Automasi Rumah Menggunakan Rangkaian Talian Kuasa dan Kawalan Jauh RF. Automasi Rumah adalah kaedah atau sistem yang akan memberi pengguna keupayaan dan kuasa untuk mengawal peralatan rumah mereka seperti kipas dan lampu dengan menggunakan telefon bimbit di mana sahaja di seluruh dunia. Automasi Rumah juga boleh digunakan dalam sistem keselamatan yang boleh mengawal penggera keselamatan rumah, mengunci pintu dan tingkap rumah, pengesan asap dan juga kamera keselamatan. Automasi Rumah Menggunakan Rangkaian Talian Kuasa dan Kawalan Jauh RF akan dibina berdasarkan telefon bimbit berasaskan Android yang akan bertindak sebagai alat kawalan jauh yang digunakan oleh pengguna, Arduino UNO sebagai mikrokontroler utama yang akan bertindak sebagai pemproses sistem yang mana akan membolehkan pelaksanaan tugas yang diberikan oleh pengguna. Modul Bluetooth HC-06 akan digunakan yang akan bertindak sebagai penghubung antara pengguna dan mikrokontroler. Analisis untuk projek ini adalah untuk menentukan keberkesanan projek Automasi Rumah Menggunakan Rangkaian Talian Kuasa Dan Kawalan Jauh RF.

ABSTRACT

This report will present the Home Automation Using Power Line Networking and RF Remote Control. The Home Automation is method or system which will give user the ability and authority to take control of their home appliances such as fan and lamp by using mobile phone anywhere around the world. The Home Automation also can be used in security system which can take control the home alarm, door and window lock, smoke detector and also security camera. The Home Automation Using Power Line Networking and RF Remote Control will be build based on Android-based mobile phone which will act as the remote control used by the user, Arduino UNO as the main microcontroller which will be act as the processor of the system which will enable the execution of task given by the user. A Bluetooth module HC-06 will be used which will act as the communication carrier between user and the microcontroller. The analysis for this project are to determine the effectiveness of the project Home Automation Using Power Line Networking And RF Remote Control.

DEDICATION

This thesis is dedicated to:

My beloved parent,

Abd Wahab Bin Rahim and Sharifah Radziah Binti Sayed Ali

My dearest siblings,

Qayyum, Aleeya, and Iqmal

My supervisor,

Mr. Zulhairi Bin Othman,

And all of my friends,

Thank you for their encouragement and unconditionally support.

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TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF SYMBOL AND ABBREVIATION

GPRS	General Packet Radio Service
Wi-Fi	Wireless Fidelity
ARM	Acorn RISC Machines
USB	Universal Serial Bus
GSM	Global System for Mobile
LED	Light Emitting Diode
SD Card	Secure Digital Memory Card
GPIO	General Purpose Input Output
HDMI	High-Definition Multimedia Interface
VGA	Video Graphic Array
PCB	Printed Circuit Board
IC	Integrated Circuit
OS	Operating System
LAN	Local Area Network
RFID	Radio-Frequency Identification

TCP/IP	Transmission Control Protocol/Internet Protocol
PWM	Pulse Width Modulation
WPAN	Wireless Personal Area Network
RXD	Receiver
TXD	Transmitter
VCC	Voltage Common Collector
GND	Ground
HAS	Home Automation System
WSN	Wireless Sensor Network
HTTP	Hypertext Transfer Protocol
EEG	Electroencephalogram
IR	Infrared
NOOBS	New Out Of Box Software

CHAPTER 1

INTRODUCTION

1.1 Overview

This project is focusing on creating a Home-Automation Structure based on wireless communication device. In this project, a combination of two structure namely wireless control device and a receiver or th Home-Automation Structure itself will be used to implement a versatile automation structure for the home, that can do almost all the home based controls that we do on daily basis. The wireless control device is a user-based control unit that will be used to do all the jobs and tasks that were related to the home based control. With the control unit, the user will have the authority to take control of the structure. The control unit will be an Andoid-based structure. Apart from that, the wireless control device should also be able to monitor all the home apparatuss within the range and gives feedback of all their status to the user. From that, user also can monitor and take action on what they desires to do and the Home-Automation Structure will take charge. As for the Home-Automation Structure, an Arduino based structure will be used to act as the receiver which receive the statistic and task from the user control unit. Besides the Arduino, there will be other apparatuss and components that will be used to execute all the task properly hence will produced a successful Home-Automation Structure. The definition of successful Home-Automation Structure is how it could help the human community to simplify their life style by helping to reduce dailywork load and also make easier to complete. Besides that, it also can help the elderly and disable persons to do the simple daily task and make it easy for them.

1.2 Problem statement

There are few problem statements that need to be highlighted when need to conduct this Home-Automation Structure based project. All of them were listed based on the real time event problem that has been faced nowadays.

The first of it is how the structure will function in everyday life style. This is because, by implementing the Home-Automation Structure it will help to improve the life style of a modern world which is everything can be done remotely everywhere and wireless. Besides that, it will improve the efficiency of doing basic home-related work such as turning light or lamp on and off when we are away from home. It also will help to monitor the our house hold condition and status where as we can observe it remotely from the control device.

After that, from this project we can help the elderly and disable persons who are either live by their own or not to do the basic house work efficiently. This is because, average elderly can not move around quickly or oftenly to turn off a light downstair without any help from others. Same goes to the disable person. They might face the difficulty to go down or upstairs to turn on and off a home mechanisms. Hence, by developing this project it could help the elderly and disable persons to fulfill the daily home-based tasks.

Next is, by developing this Home-Automation based structure it could help greatly in reducing the energy consumption in a particular house. This is because, when we can control the home mechanisms usage smartly thus it will help to greatly reduce the electrical consumption.

1.3 Objectives

There are few objectives that have been listed before doing this project. The objectives of developing this Home-Automation based structure is as follow :

- To study and analyze the Home-Automation Structure based project by using wireless device.

- To develop the Home-Automation Structure based project by using wireless device.
- To be able to help the community in controlling and monitoring their home appliances.

1.4 Project scopes

This project consist of two parts of process which is software and hardware. For the first part which is software system, the system will covered by the programming of the microcontroller that will be used which is Arduino Uno. Next is the process of designing and developing the interface of the control unit device or the remote that will be used by the user or consumer. To do this task, the usage of C-programmer and C-Compiler will be needed to fulfil the requirement.

For the second part which is hardware development part, there are two main components that will used which is the Arduino Uno and Bluetooth module. The Arduino Uno will be the brain or the system processor which will receive the information or data from the user via the control device. As for the bluetooth module, it will act as the communication carrier where they will act as transmitter and receiver. This communication carrier will play an important role where they need to convey the data and information efficiently so that the Arduino Uno can receive the information hence execute the order.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Nowaday, there are numerous technology in the jurisdiction which based on home automation, which inclusive of GPRS home automation based structure, ZigBee home automation based structure, and WiFi linked home automation based structure. However, the authority to command over those appliances through these technologies were confined to the tool efficient ranges which is in a home.

In this project, a combination of two different parts will form a complete Home-Automation based structure. The first part will be the user-based control device. This device will be used by the user to take control of all the home mechanisms that can be control. The control device also will be used to transmit the the data or order from the user to the structure. This device will be the medium between the user and structure to liaise. The second part is, the Home-Automation based structure itself. It will act as the brain of the whole structure. This structure will receive the data or order from user, then process the data and then execute the order. The structure will play a big role since it need to receive the data which is significant and then execute the order accordingly and smoothly.

2.1.1 History of home automation

The home automation based structure will grant you an authority to take charge of the appliances inside the house by using a mobile structure wherever you are in the world. The authority also applied to the secluded

programmable devices, as an example such as sprinkler and thermostats structures, regarding that, home automation based structure are more specifically describes a homes in which nearly everything that can be manipulate, monitor and mainly control such as lights, fans, electrical outlets, heating and cooling structures which all of them are established directly to a remotely controllable network. On the other hand, for safety and security point of view of a house, this is overall including your home alarm structure, for an instance such as all of the entrance to enter the house, security surveillance, fire alarms and any others different sensors that are connected to them.

The most and clear apparent beneficiaries of this resemble are "smart" units of home apparatus which use local area network that can be connected with, over the aid of Ethernet or Wi-Fi. On the other hand, home electrical connection and even individual connection, such as light and fan switches and also electrical sockets, all of them had been built-in into home automation structures.

The automation are greatly known as a part of the important role to create the home automation structure. Automation basically point out directly potential of the original set up or program and scheduled activities and also covered job description for the devices on the structure. The original program might also includes time-based commands, such as having your lights in living room either turn on and off at a specific times each days repeatedly as desiresed by user. The automation also can furthermore cover up to random fixures task or act, such as switching the lights inside the residence where you were living when the home security structure alarm being triggered.

The other most significant characteristic of modern-day home automation based system is a supervision and authority remotely. On the other hand, single direction of monitor remotely were restrained by an amount already available utterly familiar nowadays, it is only in view that this advancement of mobile phones and other mobile technology that we've had the potential by simply bind it to the home automation based networks even when the user or consumer are distant from it. By the aid of the conventional

home automation based structure, by using internet-connected based device user can take control of it to monitor and take charge of the structure and any connected home-based appliances. The home automation monitoring apps can grant a load of statistic regarding your home, from the status of the actual status or condition to a specified history of what has passed off up to until now. Users are permitted so that they can take a look and monitor at the security structure's condition and status, whether or not the lights are switch on, whether the windows and doors are locked. Besides that users also can monitor what is the contemporary temperature of your home is and a whole lot more. With cameras as part of your domestic automation based structure, you are able to even stream real-time video feeds and actually watch what is going on inside your household whilst you are away from it.

2.2 Overview of existing project

2.2.1 Smart home control using raspberry pi in internet of things environment

Based on Sushanth Chandra Addimulam (2015), few lists of old and newly invented technologies covered by scope of home automation based structure. The are some examples fo it such as GPRS primarily based domestic automation structure, ZigBee-based domestic automation structure, and Wi-Fi connected home automation based structure. The potential to control this structure over a control unit devices thru these applied sciences was once restrained to the structure efficient range which is inside a home itself.

This entire structure network is a combinational of two main blocks. The first one is a sensor networks and the second one is a decision-making circuits. Basically, some definite routine are existed to interract with the smart home which is all of that things is required to provide an Internet connection to the structure, three ways need to be execute in order to earn it. All of the parameters were listed as below :

i. Using an Ethernet cable.
ii. Using Wi-Fi.
iii. Using a GSM model.

By the purpose of this project, Raspberry Pi model 2 have been used. This model operate on a quad band ARM Cortex A-7 processor, and the Raspberry Pi has been chose due to the fact it is a total package. The specification of Raspberry Pi which satisfy the requirement because of the capability of ethernet socket and four USB usage ports. To gain the connection of internet these ports can be affiliated with the Wi-Fi dongle. The purpose of this dongle is to acquire statistic transmit by the sensors and revise the statistic to the internet and also play the role as wireless gateway.

The next parameter considered is GSM model. Futhermore, it run the task alike but it is almost impossible to use this model due to present refinements made with the aid of mobile carrier merketer. Quad-band Sim900 by way of Sim-com solely work with 2nd technology cell services where it is widely used for GSM fashions like. Many company invloving in this work field has terminate 2nd era cell services which causing no more coverage for second-generation after the successful insurance of fourth era cellular services. To interract with microcontroller and link to GSM model's internet, we have to own on a cell network to collect 2D technology packet data with the usage of GSM. The GSM model are unable to register with the network which causing a difficulty to use that model for acquiring internet connectivity since cell service carriers are no longer providing second technology services, and that would be a time wasting.

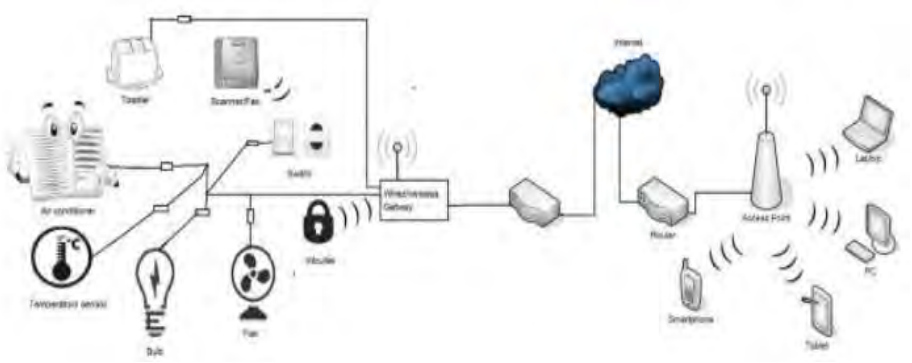

Figure 2.2.1 : Smart Home Network (Sushanth Chandra Addimulam, 2015)

We can see small circuits which is sensors and smart circuits were secure on all the gadgets and mechanisms, these sensors and decision-making circuits liaise with get admission to 14 gateway. The get entry to gateway is linked to a local router where it grant the connection of internet via which the statistics is transferred to the. The general and basic features of smart home are as below:

i. Decision making circuits :

Decision-making circuits are nothing however the sensors with a aggregate of programmable reminiscence gadget and transmitter (wired or wireless) which make decisions depending on the enter from the sensors. The sensor statistic is transformed into desktop readable format and given to the memory unit that differentiate the predefined set of course and performs an fabulous action. The carried out action and the fame of the sensor are convey to the gateway so that the consumer can comprehend the situation of that particular instrument.

ii. Power efficient devices :

High-efficiency home apparatus are used to get the equal output as the regular appliance however devour minimal power. Mechanisms like high-intensity LEDs and energy saving mechanisms are installed to make clever utilization of power barring compromising on alleviation levels.

iii. Remote access :

The main cause of smart residences is to achieve authority over home apparatus remotely. Most of the times we see, people forget about to swap off the mechanisms while rushing to work due to which they have to pay greater electrical energy payments and general breakdown of appliance's due to immoderate usage. The mechanisms, when linked to a familiar control, are available from anywhere remotely with our smartphones and computers, the user can switch them as he/she needs and display their home.

iv. Security :

We build our domestic the way we desires, and we also desires it to continue to be the equal way, so safety is furthermore the most significant difficulty in a clever home. For protection from fire, water and high temperature, gorgeous sensors should be installed to alert us in instances of furnace breakout or water leakage. Our clever home can also be inclined to robbery. To stop our house from getting robbed, we can set up cameras that document the footage in the cloud. Also to get knowledgeable on any unauthorized entries and suspicious behavior, infrared alarm structure can be organized in the fencing and entrances.

v. User friendly :

All the individuals dwelling in the house may furthermore now not be conscious of the today's technology (elderly people), so the operation of these mechanisms need to be without complication understandable for people of all age groups. A easy structure is designed so that consumer can troubleshoot on its self. The interface of oversee also be as simple and friendly as possible.

Designing a handy model to have commands over gadgets without complication is the primary objective of the proposed structure. It is also :

i. Power efficient.
ii. Cost efficient.
iii. Remotely operable.
iv. Creating a smart gateway to liaise.
v. Intelligible interface.
vi. Add on to way of life of user.

The list of components that has been used for completing this project are as below :

i. Raspberry Pi 2 :

Raspberry Pi is palm sized board or computer designed via the United Kingdom primarily based Raspberry Pi foundation, who designed and evolved Raspberry Pi to introduce the fundamentals of laptop structures to students. The version of Raspberry Pi we've used in this project is Raspberry Pi 2 that's the cutting-edge version released thru Raspberry basis in advance in 2015. This version of Pi comes with a Quad-center ARM Cortex A7 processor with one Gigabyte of programmable RAM reminiscence. On